Journal of the Nigerian Statistical Association Vol. **28**, 2016, 79– 94

Analysis of Agriculture and Gross Domestic Product of Nigeria using First Difference Regression Model

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The dwindling oil price in the international market reveals the fact that the Nigerian economy need to be diversified to develop the non-oil sector, of which agriculture is an example of the non-oil sector. It well reported in the literature that agriculture in Nigeria is a major sector of the economy, providing employment for about 70% of the population. This paper examines the relationship between agriculture and GDP in Nigeria using data from 1960 to 2014. Annual data for agriculture and GDP was extracted from CBN Statistical Bulletin. The ADF test revealed that agriculture and GDP variables are stationary at first difference. The evidence from bound testing and Johansen cointegration test revealed that agriculture and GDP variables are not cointegrated. Lastly, evidence from first difference revealed that 1% increase in the change of agriculture leads to about 90.86% increase in the change of GDP. This paper recommends that in this period of fall in oil price, investment that will grow the agricultural sector should be encouraged so as to enhance economic growth.

Keywords: Modelling; agricultural sector; Gross Domestic Product (GDP); bound testing; Johansen cointegration test; first difference regression.

1. Introduction

Agriculture has remained a major sector of the Nigerian economy on which the government hopes to achieve food sufficiency and reduce unemployment (Anaebonam, 2014). Agriculture is a major sector of the Nigerian economy, providing employment for about 70% of the population. According to Achinewhu and Opigo (2013), agriculture between 1960 and 1965 was the mainstay of Nigeria's economy, contributing up to 60% of GDP. Unfortunately, the discovery of petroleum has led to the neglect of agriculture (Yakubu and Akanegbu, 2015). However, the fall in oil price in the international market has shown the need to develop non-oil sectors, such as (Yakubu and Akanegbu, 2015).

Aminu and Anono (2012) examined the contribution of agriculture sector and petroleum sector to the economy growth and development of the Nigerian economy between 1960 and 2010. They reported that the agricultural sector contributed higher to GDP than the petroleum sector.

The present day government of Nigeria has been experiencing lack of fund as a result of fall in oil price in the international market; this has result to unpaid workers' salaries and lack of infrastructural development in the country. One way to solve this problem is to diversify the economy by harnessing the potentials of non-oil sectors such as agricultural sector.

The aim of this paper is to examine the relationship between the agricultural sector and GDP in Nigeria from 1960 to 2014 employing Bound Testing, Johansen cointegration test, and first difference regression model.

Gross Domestic Product (GDP) is an internationally recognized measure of economic size and strength (Oyedele, 2017). More GDP in Nigeria can stimulate the economy. At such, it led to economic prosperity and creation of employment, thereby by reducing the poverty rate of Nigerians.

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2. Literature Review

Awe (2003) examined the mobilization of domestic financial resources for agricultural productivity in Nigeria using Vector Autoregressive (VAR) model. The study reported a positive relationship between agricultural posture and government recurrent expenditure on agriculture, agricultural credit scheme and bank loan to agricultural sector in Nigeria. He recommended that the government recurrent expenditure on agriculture should be reviewed upward for enhanced agricultural productivity.

Ogen (2007) studied the agricultural sector and Nigeria's development as compared to the Brazilian agro-industrial economy, 1960-1995. The work concluded that Nigeria and other third world countries need to urgently develop their monumental agricultural potentials if they are to achieve rapid industrial and economic development.

Yahaya and Olajide (2005) examined the impact of Nigerian Agricultural Cooperative Bank (NACB) on beneficiaries with a view to position the bank very well in the unfolding circumstance. They reported that there was a significant difference between farmers social economic status before and after loan procurement. They recommended that NACB should be empowered to discharge its statutory roles to enhance performance.

Awe and Ajayi (2009) determined the effect of non-oil revenue on economic development. They found that there exist a significant relationship between agriculture and solid minerals. They suggested the necessity of upgrading basic infrastructure so as to create conducive environment for expanded output in the non-oil sector of the Nigerian economy.

Liverpool-Tasie et al. (2011) reported that the neglect of the agricultural sector, as Nigeria became dependent on oil, has been a disaster for the country.

Olurankinse and Bayo (2012) analyzed the impact of non-oil export on the growth of the Nigerian economy. The findings revealed that the non-oil export has a positive impact on the growth of the Nigerian economy during the period, although its performance in terms of output level and revenue generation was poor. They recommended the need to increase production in both the agricultural and the manufacturing sectors so as to enhance product availability.

Bakare (2012) reported that agriculture is one of the important economic sectors in Nigeria. The study suggested the need for the policy makers in Nigeria to proffer policy that will promote agriculture to a sustainable level.

Ugwu and Kanu (2012) reviewed the various economic reform strategies on agriculture undertaken by the Nigeria government for about three decades. The contribution of agriculture was low due to problems such as policy instability, lack of transparency etc.

Olajide et al. (2012) investigated the interrelationship between GDP and agricultural output in Nigeria. The work revealed that there exists a positive and significant effect between agriculture and GDP in Nigeria.

Akpan (2012) carried out a comparative assessment of the practical impact of long years of policy practice produced for Nigeria's rural areas within the context of two distinguishing economic periods characterized by agricultural production and petroleum oil exploration. The result revealed that rural development in Nigeria has not been successful. The work concluded that challenge of leadership, absence of institutional capacity and political commitments are the main factors working against the development of rural areas.

Odetola and Etumnu (2013) investigated the contribution of the agricultural sector to economic growth in Nigeria using growth accounting framework and time series data from 1960 to 2011. The work reported that the agricultural sector has contributed positively and consistently to economic growth, therefore reaffirming the sectors importance in the Nigerian economy.

Adenomon and Oyejola (2013) examined the impact of agricultural and industrial sectors on GDP in Nigeria from 1960 to 2011. Adenomon and Oyejola reported that agriculture contributed about 50% to GDP while industrial sector contributed 32% to GDP in Nigeria.

Omorogiuwa et al (2014) reviewed the role of agriculture in the economic development of Nigeria. They reported that development in the agricultural sector is essential to the progress of the Nigerian economy.

Oni (2014) examined the role of agriculture in poverty reduction in Nigeria between 1980 and 2011. Oni reported that agriculture is the key driver of growth in recent years with high potential of reducing poverty among Nigerians. Evidence from Augmented Dicker Fuller (ADF) unit root test and Error Correction Model (ECM) revealed that per capita agriculture GDP, physical infrastructure per capita and social infrastructure per capita were positively and significantly related to poverty reduction while per capita non-agricultural GDP and inflation rate were negatively and insignificantly related to poverty reduction in Nigeria. The study recommended that government should provide the needed subsidy to Nigerian farmers with a view to transforming and adapting to the use of modern technology so as to increase productivity and reduce the level of poverty in Nigeria.

Other authors such as Yakubu and Akanegbu (2015) examined the neglect of agriculture and its consequences to the Nigerian economy. Iganiga and Unemhilin (2011) also examined the impact of Federal government expenditure on agricultural output in Nigeria.

3. Materials and Method

3.1 *Johansen and Juselius cointegration test*

The most popular test for cointegration testing is the Johansen and Juselius cointegration test (i.e. the maximum eigenvalue test and the trace test) (Johansen and Juselius, 1990). The maximum eigenvalue test and the trace test are used as procedures to determine the number of co-integration vectors.

The maximum eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative of $r+1$ cointegrating relations for $r = 0, 1, 2, \cdots, n-1$. This test statistic is given as

$$\lambda_{\max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1})$$

where $\hat{\lambda}$ is the computed maximum eigenvalues of r (where $r = 0, 1, 2, \cdots, n-1$) and T stands for the sample size.

Trace statistic examines the null hypothesis of r cointegrating relations against the alternative of n cointegrating relations, where n is the number of variable in the system for $r = 0, 1, 2, \cdots, n-1$.

It is computed according to the following formula

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i)$$

The main difference between the maximum eigenvalue test and the trace test is that the trace test is a joint test, whereas the maximum eigenvalue test conducts separate test on the individual eigenvalues (Habte, 2014).

3.2 *Autoregressive Distributed Lag (ARDL) model*

Pesaran et al. (2001) proposed an Autoregressive Distributed Lag (ARDL)/bounds testing approach to investigate the existence of cointegration relationship among variables. There are three specific advantages associated with this approach (Udoh et al., 2015):

1. It circumvents the problem of the order of integration associated with the Johansen likelihood approach.
2. Unlike most of the conventional multivariate cointegration procedures which are valid for large sample size, the bounds test approach is suitable for sample size

study.

3. It provides unbiased estimates of the long run model and valid t-statistics even when some of the regressors are endogenous.

Autoregressive Distributed Lag (ARDL) Models have played a prominent role in numerous application in the Nigerian economy (see Udoh et al, 2015; Doguwa and Alade, 2015; Udom and Yaaba, 2015; Musa and Gulumbe, 2014).

The ARDL model specification of the functional relationship between the GDP and agricultural sector is given as

$$\Delta LNGDP = \alpha_0 + \beta_1 LNGDP_{t-1} + \beta_2 LNAGRIC_{t-1} + \sum_{i=1}^{k} \delta_{1i} \Delta LNGDP_{i-1} + \sum_{i=1}^{k} \delta_{2i} \Delta LNAGRIC_{i-1} + \epsilon_t \quad (1)$$

where $LNGDP$ = natural Log of GDP, $LNAGRIC$ = natural Log of agricultural sector, K = lag length for the Unrestricted Error- Correction Model (UECM), Δ = first differencing operator, ϵ = white noise disturbance error term. The unit of measurement for agricultural sector and GDP in Nigeria are in billion naira (that is annual amount accruing from the sector).

The bound test approach for the long-run relationship between GDP and agricultural sector is based on the Wald test (F statistic), by imposing restrictions on the long-run estimated coefficients of one period lagged level of the GDP and agricultural sector to be equal to zero, that is, $H_0 : \beta_1 = \beta_2 = 0$. Then the calculated F statistic is compared to the tabulated critical value in Pesaran et al. (2001).The explanatory variables are assumed to be integrated of order zero, i.e., $I(0)$ for values of the lower bound, while the upper bound values assumed that they are integrated of order one, i.e., $I(1)$. Therefore, the decision rule is that if computed F-statistic falls below the lower bound value, $I(0)$, the null hypothesis (no co-integration) cannot be rejected. While if the computed F-statistic exceeds the upper bound value, $I(1)$ then it can be concluded that GDP and agricultural sector are co-integrated. But if the computed F-statistics falls in between the lower and upper critical values, the result is inconclusive.

3.3 *First difference regression model*

Classical first difference regression model is of the form

$$\Delta y_t = (\Delta x_t)' \beta + u_t$$

where $\Delta y_t = y_t - y_{t-1}$, Δx_t is a $k \times 1$ vector of first differences, $(\Delta x_t)'$ is the transpose of the $k \times 1$ vector of the first difference, β is a $k \times 1$ vector of unknown parameters and $u_t \sim NID(0, \sigma_1^2)$. The above model does not include a constant term since this would imply a linear time trend in the model (Harvey, 1980). Harvey revealed that the residual sums of squares in first difference regression model was smaller compare to the residual sums of squares in the level regression model. Granger and Newbold (1974) stressed that spurious correlation are less likely occur with variable in first difference, and that have led some researchers to adopt first difference formulation automatically.

4. Results and Discussion

The data used in this paper was sourced from CBN 2011 and 2014 Statistical Bulletin. The data on annual GDP and Agricultural sector spanned from 1960 to 2014, and it is presented in Table 11 in the appendix. The unit of measurement for agricultural sector and GDP in Nigeria are in billion naira. Before proceeding with econometric estimations, it is required to obtain the optimal lag of the model and to investigate the integration properties of the variables. The optimal lag selection using the AIC criterion, choose VAR(1) as optimal (Table 6 in the appendix), and choose ARDL(1,1) as optimal (see Table 7 in the appendix). The unit root test using the Augmented Dickey Fuller (ADF) test presented in Table 1 below revealed that the variables are stationary at their first difference and see detail in Tables 4 and 5 presented in the appendix. Meaning that the variables are stable for econometrics analysis.

Table 1: ADF test for unit root

Variable	Intercept only	Intercept and Trend
D(LNGDP)	-6.225141*	-6.389051*
D(LNAGRIC)	-5.300602*	-5.478915*
*Significant at 1%, 5% and 10% level of significance		

Table 2: First difference regression

Dependent Variable: D(LNGDP)
Method: Least Squares
Date: 07/23/16 Time: 12:42
Sample (adjusted): 1961 2014
Included observations: 54 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNAGRIC)	0.908623	0.094920	9.572512	0.0000

R-squared	0.238626	Mean dependent var	0.196176
Adjusted R-squared	0.238626	S.D. dependent var	0.190743
S.E. of regression	0.166436	Akaike info criterion	-0.730062
Sum squared resid	1.468157	Schwarz criterion	-0.693229
Log likelihood	20.71167	Hannan-Quinn criter.	-0.715857
Durbin-Watson stat	2.015303		

Next is to investigate the cointegration between GDP and agriculture using the Johansen cointegration testing procedure, that is, the trace and the maximum eigenvalue test. The tests revealed that there is no cointegration between GDP and agricultural sector (see Table 8 in the appendix). This means that between 1960 and 2014 in Nigeria, there is no long run association between GDP and agricultural sector. In addition, the Vector Error Correction Model cannot be used because there is no long run association.

The bound testing was also carried out on GDP and agricultural sector. In Tables 9 and 10 in the appendix, the F-statistics= 0.530941 was obtained using the Wald test, while the Pesaran critical values are Lower bound= 3.38 and upper bound= 4.02. The F statistic is less than 3.38, we cannot reject the null hypothesis. This means that the two variables (GDP and Agricultural sector) does not have a long run association. This suggests the non-existence of co-integration between the two variables. Thus, Autoregressive Distributed Lag (ARDL) model cannot be used to model GDP and agricultural sector because there is no long run association. The available option is to model GDP and agricultural sector using first difference regression model because GDP and agricultural sector are stationary at first difference. The detail result of the model is given in Table 2 below.

The estimated first difference model is given as: D(LNGDP)= 0.908623 D(LNAGRIC) which revealed that agricultural sector is positively related to GDP in Nigeria. The model further revealed that 1% change is agricultural sector causes about 90.8% change in GDP.

This means that agricultural sector contributed about 90.8% to the GDP in Nigeria between the period under consideration. This result is similar to the results of Olajide et al (2012); Aminu and Anono (2012); Adenomon and Oyejola (2013) etc.

The Table 3 in the Appendix test for serial correlation in the residual of the estimated first difference regression model. The test revealed absence of serial correlation in the residual (P-value= 0.9517 > 0.05).

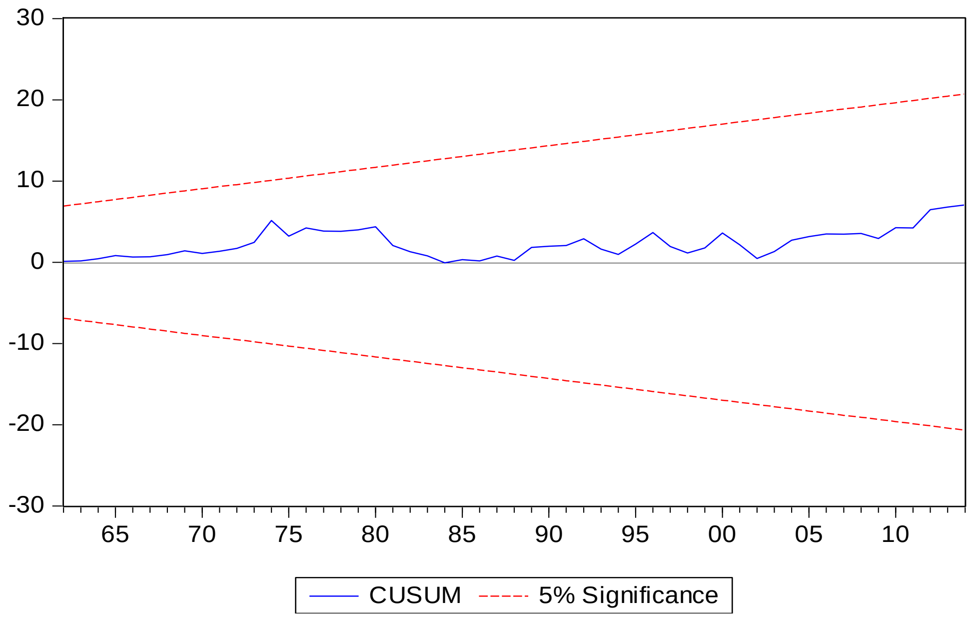

Figure 1. CUSUM stability test

The stability test in Fig. 1 above revealed that the estimated first difference regression model is stable. Hence the model can be used for the purpose of forecasting.

5. Conclusion

This paper investigated the interrelation between GDP and agricultural from 1960 to 2014. Result from the ADF test revealed the GDP and agricultural sector variables are stationary at first difference. The Johansen cointegration test and bound testing revealed that there is no cointegration between GDP and agricultural sector, that is, there is no long run association between GDP and agricultural sector during the period under review. This result further revealed that models such as Vector Error Correction Model (VECM) and Autoregressive Distributed Lag (ARDL) model for studying long run association between economic variables become impossible because there is no cointegration between the economic variables under consideration. This situation therefore makes first difference regression model a viable model to study GDP and agricultural sector in Nigeria. The estimated first difference model revealed that agricultural sector is positively related to GDP in Nigeria. The model further revealed that 1% change in agricultural sector will cause about 90.8% change in GDP. This means that agricultural sector contributed about 90.8% to the GDP in Nigeria between the period under consideration. This study therefore concludes that the agricultural sector has potentials to increase the GDP of Nigeria. This paper recommends that in this period of fall in oil price, investment that will grow the agricultural sector should be encouraged so as to enhance economic growth.

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Appendix

Table 3: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.003699	Prob. F(1,52)	0.9517
Obs*R-squared	0.000000	Prob. Chi-Square(1)	1.0000

Table 4: Unit Root for Agricultural Sector variable
Null Hypothesis: D(LNAGRIC) has a unit root (intercept only)
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.300602	0.0000
Test critical values:	1% level	-3.560019	
	5% level	-2.917650	
	10% level	-2.596689	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNAGRIC) has a unit root (intercept and Trend)
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.478915	0.0002
Test critical values:	1% level	-4.140858	
	5% level	-3.496960	
	10% level	-3.177579	

*MacKinnon (1996) one-sided p-values.

Table 5: Unit Root Test for GDP Variable
Null Hypothesis: D(LNGDP) has a unit root (intercept only)
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.225141	0.0000
Test critical values:	1% level	-3.560019	
	5% level	-2.917650	
	10% level	-2.596689	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNGDP) has a unit root (intercept and Trend)
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.389051	0.0000
Test critical values:	1% level	-4.140858	
	5% level	-3.496960	
	10% level	-3.177579	

*MacKinnon (1996) one-sided p-values.

Table 6: VAR Lag Order Selection Criteria
Endogenous variables: LNAGRIC LNGDP
Exogenous variables: C
Date: 07/23/16 Time: 12:23
Sample: 1960 2014
Included observations: 50

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-131.6654	NA	0.719551	5.346615	5.423096	5.375740
1	43.61317	329.5237*	0.000762*	-1.504527*	-1.275084*	-1.417154*
2	45.23848	2.925569	0.000838	-1.409539	-1.027135	-1.263917
3	46.01864	1.341871	0.000956	-1.280746	-0.745379	-1.076875
4	46.22905	0.345076	0.001117	-1.129162	-0.440834	-0.867043
5	49.33564	4.846282	0.001166	-1.093426	-0.252136	-0.773058

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 7: Lag Selection Criteria for ARDL Model

ARDL Model	AIC	SC	Log likelihood	F Wald test	P of Wald test
ARDL(1,1)	**-0.762815**	**-0.576939**	**25.21461**	**1.515190**	**0.230100**
ARDL(1,2)	-0.701951	-0.476808	24.25074	1.242458	0.298200
ARDL(1,3)	-0.643728	-0.378576	23.41508	1.124053	0.334100
ARDL(1,4)	-0.601325	-0.295401	23.03312	1.127577	0.333400
ARDL(1,5)	-0.549112	-0.201634	22.45323	0.517626	0.599900
ARDL(1,6)	-0.482085	-0.092252	21.57004	0.269735	0.765000
ARDL(1,7)	-0.553546	-0.120533	24.00834	0.116058	0.890800
ARDL(1,8)	-0.530281	-0.053244	24.19647	0.188141	0.829400
ARDL(1,9)	-0.469880	0.052045	23.57229	0.086040	0.917800
ARDL(1,10)	-0.448320	0.119377	23.86303	0.058011	0.943700
ARDL(2,1)	-0.717977	-0.492834	24.66741	1.578281	0.217300
ARDL(2,2)	-0.682955	-0.420287	24.75682	1.169454	0.319800
ARDL(2,3)	-0.621324	-0.318292	23.84375	0.954332	0.393100
ARDL(2,4)	-0.574926	-0.230762	23.37316	0.910875	0.410200
ARDL(2,5)	-0.524769	-0.138683	22.85683	0.349265	0.707400
ARDL(2,6)	-0.455674	-0.026857	21.93618	0.179028	0.836800
ARDL(2,7)	-0.559655	-0.087277	25.15189	0.164528	0.848900
ARDL(2,8)	-0.538109	-0.021319	25.37650	0.423862	0.658000
ARDL(2,9)	-0.464729	0.097344	24.45639	0.363163	0.698400
ARDL(2,10)	-0.427676	0.180571	24.40887	0.187710	0.829900

ARDL(3,1)	-0.656008	-0.390856	23.72821	1.266132	0.292000
ARDL(3,2)	-0.620453	-0.317422	23.82156	0.930310	0.402200
ARDL(3,3)	-0.582177	-0.241267	23.84551	0.926408	0.403900
ARDL(3,4)	-0.535937	-0.153533	23.39844	0.896778	0.415900
ARDL(3,5)	-0.484184	-0.059490	22.86252	0.344445	0.710800
ARDL(3,6)	-0.414164	0.053636	21.93994	0.177017	0.838500
ARDL(3,7)	-0.517105	-0.005362	25.15197	0.159586	0.853100
ARDL(3,8)	-0.496869	0.059674	25.42798	0.443181	0.645900
ARDL(3,9)	-0.422011	0.180210	24.49524	0.377643	0.688700
ARDL(3,10)	-0.386872	0.261924	24.51119	0.242281	0.786500
ARDL(4,1)	-0.609237	-0.303314	23.23094	0.650413	0.527000
ARDL(4,2)	-0.573438	-0.229274	23.33594	0.431673	0.652300
ARDL(4,3)	-0.535169	-0.152764	23.37922	0.453097	0.638900
ARDL(4,4)	-0.541543	-0.120897	24.53856	0.781435	0.464800
ARDL(4,5)	-0.481114	-0.017811	23.78729	0.371316	0.692400
ARDL(4,6)	-0.409313	0.097470	22.82352	0.234433	0.792300
ARDL(4,7)	-0.506624	0.044484	25.90567	0.189371	0.828400
ARDL(4,8)	-0.480878	0.115418	26.06020	0.477922	0.624600
ARDL(4,9)	-0.405395	0.236974	25.12138	0.286319	0.753100
ARDL(4,10)	-0.360397	0.328949	24.92873	0.180604	0.835800
ARDL(5,1)	-0.552741	-0.205264	22.54215	0.340027	0.713800
ARDL(5,2)	-0.517200	-0.131115	22.67141	0.188105	0.829300
ARDL(5,3)	-0.478139	-0.053445	22.71441	0.209133	0.812200
ARDL(5,4)	-0.487759	-0.024456	23.95009	0.445495	0.643900
ARDL(5,5)	-0.447090	0.054821	23.95372	0.374790	0.690100
ARDL(5,6)	-0.373954	0.171813	22.97490	0.263724	0.769700
ARDL(5,7)	-0.468019	0.122454	25.99845	0.215405	0.807400
ARDL(5,8)	-0.441704	0.194345	26.15920	0.499537	0.611800
ARDL(5,9)	-0.363716	0.318800	25.18362	0.302692	0.741200
ARDL(5,10)	-0.317998	0.411898	24.99595	0.191096	0.827200
ARDL(6,1)	-0.483504	-0.093670	21.60409	0.298749	0.743500
ARDL(6,2)	-0.447085	-0.018268	21.73003	0.155590	0.856500
ARDL(6,3)	-0.407084	0.060716	21.77002	0.174299	0.840800
ARDL(6,4)	-0.415297	0.091487	22.96712	0.382745	0.684800
ARDL(6,5)	-0.373793	0.171974	22.97104	0.325833	0.724200
ARDL(6,6)	-0.332480	0.252271	22.97951	0.247352	0.782300
ARDL(6,7)	-0.428535	0.201302	26.07058	0.174592	0.840600
ARDL(6,8)	-0.402573	0.273229	26.25917	0.459414	0.636200
ARDL(6,9)	-0.324515	0.398150	25.30159	0.265317	0.768900
ARDL(6,10)	-0.273884	0.496561	25.02546	0.153294	0.858700
ARDL(7,1)	-0.620227	-0.187214	25.57533	0.325139	0.724500
ARDL(7,2)	-0.601645	-0.129267	26.13867	0.413696	0.664400
ARDL(7,3)	-0.559258	-0.047515	26.14257	0.402030	0.672100
ARDL(7,4)	-0.569624	-0.018516	27.38616	0.463914	0.632900

ARDL(7,5)	-0.527070	0.063402	27.38616	0.437728	0.649300
ARDL(7,6)	-0.484589	0.145249	27.38783	0.425050	0.657500
ARDL(7,7)	-0.448896	0.220306	27.54906	0.429834	0.654600
ARDL(7,8)	-0.415252	0.300304	27.55079	0.607431	0.551800
ARDL(7,9)	-0.335675	0.427138	26.55268	0.353895	0.705300
ARDL(7,10)	-0.299801	0.511195	26.59561	0.379583	0.688200
ARDL(8,1)	-0.582368	-0.105331	25.39446	0.309213	0.736100
ARDL(8,2)	-0.570010	-0.053220	26.11022	0.593777	0.558000
ARDL(8,3)	-0.526700	0.029843	26.11410	0.576993	0.567300
ARDL(8,4)	-0.533525	0.062771	27.27107	0.526895	0.595600
ARDL(8,5)	-0.490057	0.145992	27.27130	0.495839	0.614000
ARDL(8,6)	-0.446935	0.228867	27.27950	0.479568	0.623900
ARDL(8,7)	-0.413176	0.302379	27.50305	0.516877	0.602000
ARDL(8,8)	-0.371988	0.383321	27.55572	0.529680	0.594800
ARDL(8,9)	-0.291336	0.511625	26.55506	0.313600	0.733600
ARDL(8,10)	-0.254557	0.596988	26.60025	0.344795	0.712000
ARDL(9,1)	-0.526535	-0.004610	24.84703	0.483353	0.621100
ARDL(9,2)	-0.530766	0.031307	25.94223	0.938417	0.402100
ARDL(9,3)	-0.493588	0.108633	26.10572	1.012425	0.375400
ARDL(9,4)	-0.491562	0.150807	27.06015	0.878880	0.426000
ARDL(9,5)	-0.447558	0.234959	27.07005	0.824960	0.448600
ARDL(9,6)	-0.403315	0.319350	27.07459	0.798352	0.460400
ARDL(9,7)	-0.364167	0.398646	27.19375	0.790778	0.464100
ARDL(9,8)	-0.319977	0.482984	27.19948	0.752861	0.481400
ARDL(9,9)	-0.298782	0.544327	27.72259	0.515455	0.603700
ARDL(9,10)	-0.263213	0.628882	27.79069	0.562835	0.577600
ARDL(10,1)	-0.514460	0.053237	25.31811	0.856755	0.434700
ARDL(10,2)	-0.505655	0.102592	26.12440	1.088095	0.350200
ARDL(10,3)	-0.482342	0.166455	26.61152	1.291301	0.290800
ARDL(10,4)	-0.464097	0.225249	27.21013	0.991580	0.384100
ARDL(10,5)	-0.418840	0.311056	27.21448	0.934333	0.405600
ARDL(10,6)	-0.374368	0.396078	27.23609	0.910916	0.415100
ARDL(10,7)	-0.329338	0.481658	27.24543	0.825099	0.450200
ARDL(10,8)	-0.284618	0.566927	27.26159	0.778716	0.470700
ARDL(10,9)	-0.280646	0.611449	28.17421	0.773217	0.473700
ARDL(10,10)	-0.240269	0.692376	28.28591	0.772011	0.474800

Table 8: Johansen Cointegration Test
Date: 07/23/16 Time: 12:19 Sample (adjusted): 1962 2014
Included observations: 53 after adjustments Series: LNAGRIC LNGDP
Trend assumption: Linear deterministic trend
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.110427	7.029799	15.49471	0.5742
At most 1	0.015503	0.828069	3.841466	0.3628

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.110427	6.201729	14.26460	0.5875
At most 1	0.015503	0.828069	3.841466	0.3628

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LNAGRIC	LNGDP
-3.941984	3.839795
0.642291	-0.302542

Unrestricted Adjustment Coefficients (alpha):

D(LNAGRIC)	0.035029	0.014155
D(LNGDP)	-0.015649	0.022294

1 Cointegrating Equation(s): Log likelihood 49.86406

Normalized cointegrating coefficients (standard error in parentheses)

LNAGRIC	LNGDP
1.000000	-0.974077
	(0.03280)

Adjustment coefficients (standard error in parentheses)

D(LNAGRIC)	-0.138085
	(0.08505)
D(LNGDP)	0.061689
	(0.10389)

Table 9: Standard ARDL Model
Dependent Variable: D(LNGDP)
Method: Least Squares
Date: 07/23/16 Time: 12:33
Sample (adjusted): 1962 2014
Included observations: 53 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.120942	0.115431	1.047744	0.3000
D(LNGDP(-1))	0.051721	0.179472	0.288183	0.7744
D(LNAGRIC(-1))	0.189184	0.202012	0.936497	0.3537
LNGDP(-1)	-0.066835	0.101812	-0.656454	0.5147
LNAGRIC(-1)	0.076009	0.105573	0.719965	0.4750

R-squared	0.068514	Mean dependent var	0.198823
Adjusted R-squared	-0.009110	S.D. dependent var	0.191565
S.E. of regression	0.192436	Akaike info criterion	-0.368522
Sum squared resid	1.777510	Schwarz criterion	-0.182645
Log likelihood	14.76583	Hannan-Quinn criter.	-0.297043
F-statistic	0.882640	Durbin-Watson stat	2.006203
Prob(F-statistic)	0.481448		

Table 10: Bound Testing
Wald Test
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.530941	(2, 48)	0.5915
Chi-square	1.061881	2	0.5881

Null Hypothesis: C(4)=C(5)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	-0.066835	0.101812
C(5)	0.076009	0.105573

Restrictions are linear in coefficients.

Table 11: Annual data for Agriculture and GDP in Nigeria from 1960 to 2014

year	Agric (₦ Billion)	GDP (₦ Billion)
1960	1418.14	2233
1961	1501.77	2361.38
1962	1605.84	2597.49
1963	1673.88	2755.9
1964	1676.39	2894.3
1965	1691.55	3110.07
1966	1855.11	3374.83
1967	1527.82	2752.6
1968	1415.16	2656.33
1969	1711.63	3549.28
1970	2556.51	5281.15
1971	3033.58	6650.85
1972	3092.7	7187.4
1973	3261.2	8630.5
1974	4197.9	18823
1975	5872.9	21475.2
1976	6121.9	26655.7
1977	7401.6	31520.4
1978	8033.6	34540.1
1979	9213.2	41974.7
1980	10011.5	49632.4
1981	13580.3	47619.7
1982	15905.4	49069.3
1983	18837.2	53107.4
1984	24799.4	59622.6
1985	26625.3	67908.6
1986	27887.5	69146.9
1987	39204.2	105222.8
1988	57924.3	139085.4
1989	69713.1	216797.6
1990	84344.6	267550
1991	97464.1	312139.8
1992	145225.2	532613.9
1993	231832.6	683869.8
1994	349244.9	899863.3
1995	619806.8	1933211.5
1996	683686	2702719.2
1997	953549.3	2801972.6
1998	1057584	2708430.8
1999	1127693.2	3194014.9
2000	1192910	4582127.3
2001	1594895.5	4725086
2002	3357062.9	6912381.3
2003	3624579.6	8487031.5
2004	3903758.6	11411067
2005	4773198.3	14572239
2006	5940237	18564594.7
2007	6757867.4	20657304.5
2008	7981397.3	24296329.3
2009	9193851.7	24712669.9
2010	10310655.6	33984754.13
2011	11590120.2	37543654.7
2012	15816000	71713940
2013	16816550	80092560
2014	18018610	89043620

Source: CBN